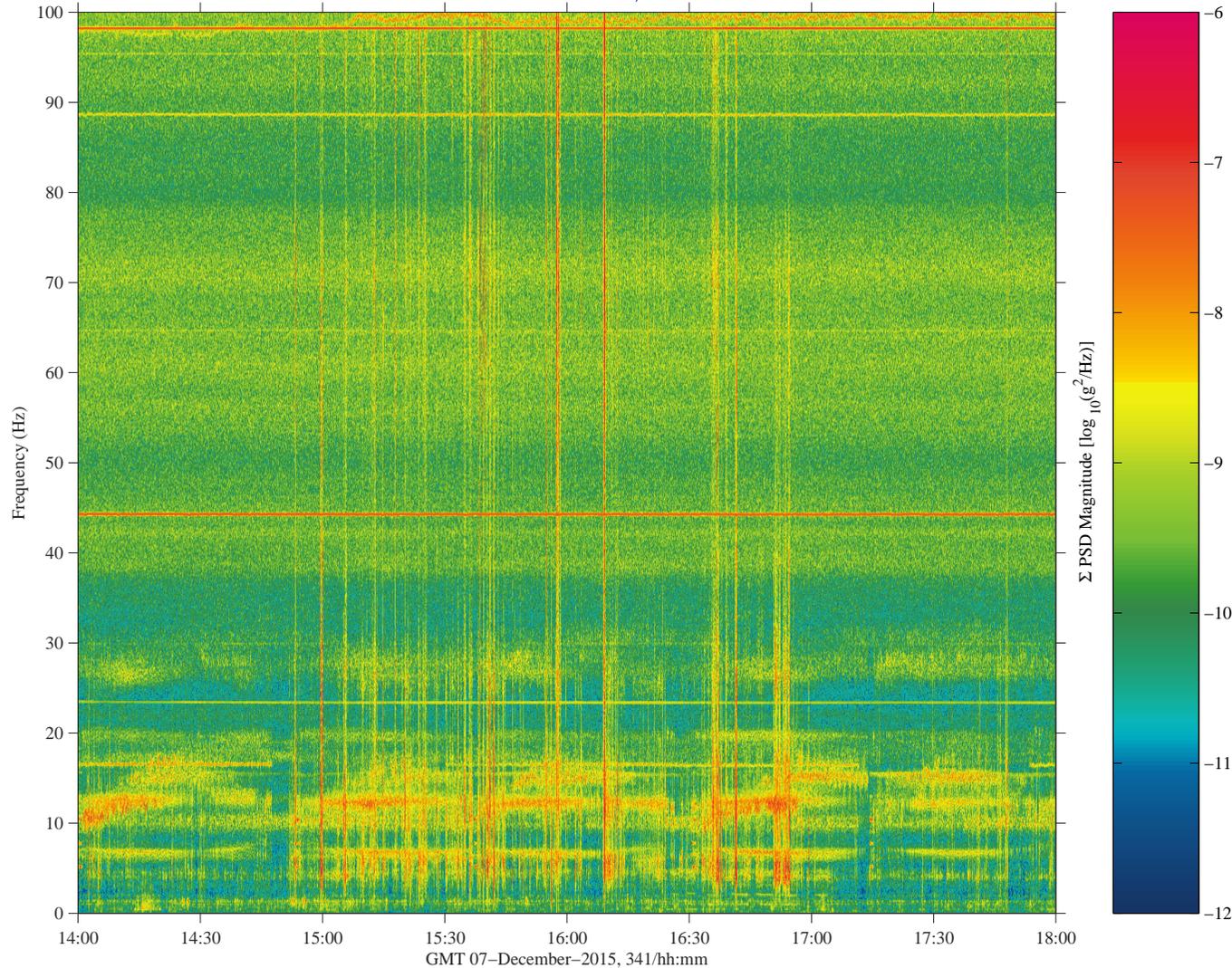


MSG Troubleshooting and Repair Qualify

mams, hirap at LAB1O2, ER1, Lockers 3,4:[138.68 -16.18 142.35]
 1000.0000 sa/sec (100.00 Hz)
 $\Delta f = 0.122$ Hz, Nfft = 8192
 Temp. Res. = 8.192 sec, No = 0

Microgravity Science Glovebox (MSG) Troubleshooting and Repair

Start GMT 07-December-2015, 341/14:00:00

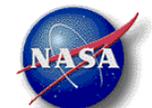


Description	
Sensor	MAMS hirap 1000.0 sa/sec, 100.0 Hz
Location	LAB1O2, ER1, Lockers 3,4
Plot Type	Spectrogram

Notes:

- The color spectrogram here shows a 4-hour span around the 15:00-17:00 (2-hour) window allocated for crew activity to troubleshoot and repair the Microgravity Science Glovebox (MSG), which is rack location LAB1S2. The measurements used to compute this spectrogram came from the MAMS HiRAP sensor in ER1, LAB1O2.
- Downlink video showed the crew rotating MSG down in order to get around back to work on a stuck slide rail, which was preventing the MSG from being slid in/out.
- The issue was a fixed slide pin had jumped a movable slide end stop preventing the core facility from extending out to full position.
- The procedure for remedy by the crew called for using some brute force to unstick what was stuck.
- The vertical orange-red streaks between about 15:00 and 17:00 qualitatively show the impact on the microgravity environment of this activity. Later plots will quantify the impact.

Regime:	Vibratory
Category:	Equipment
Source:	MSG Troubleshooting and Repair

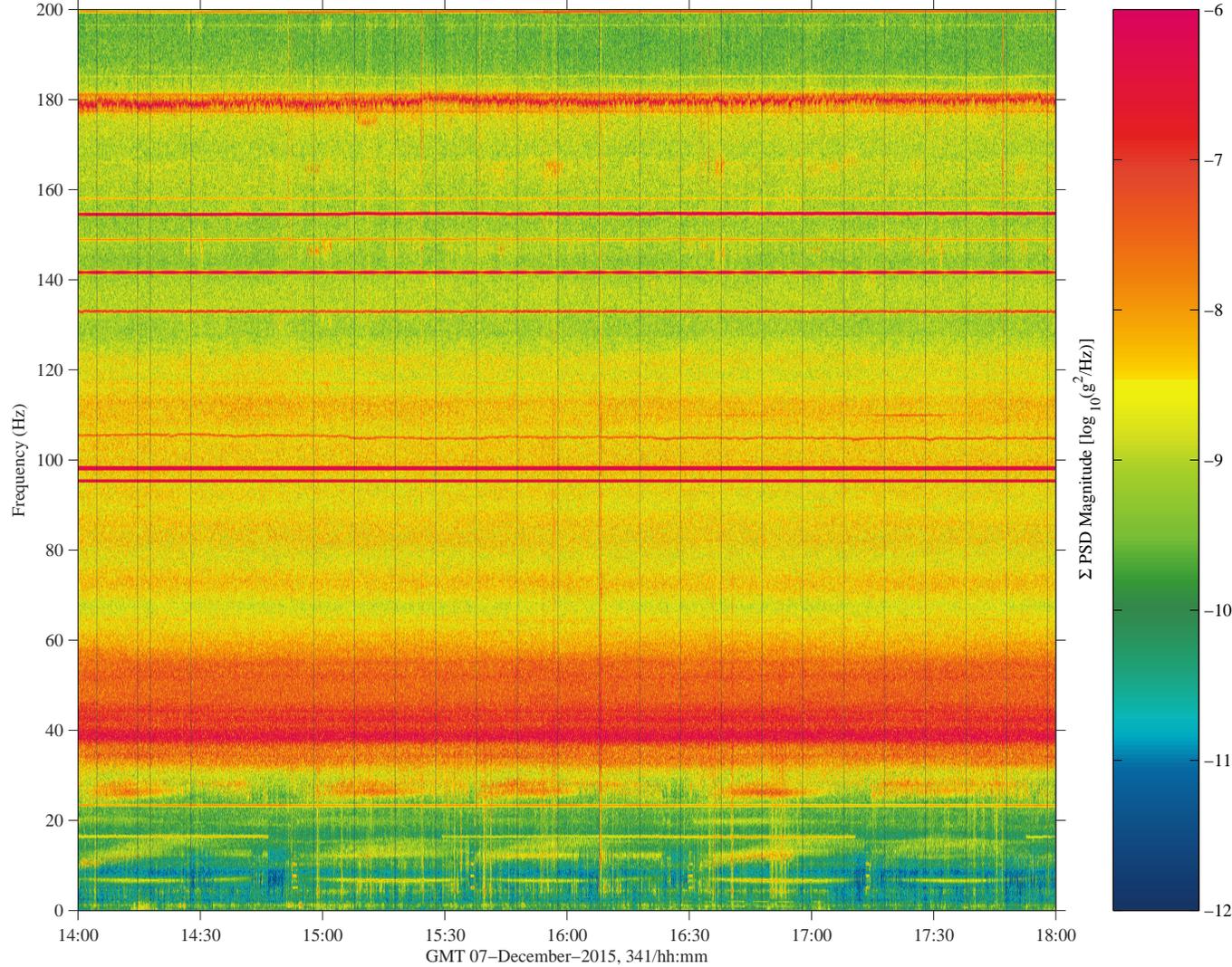


MSG Troubleshooting and Repair Qualify

sams2, 121f04 at LAB1O2, ER1, Lower Z Panel:[149.54 -40.54 135.25]
 500.0000 sa/sec (200.00 Hz)
 $\Delta f = 0.244$ Hz, Nfft = 2048
 Temp. Res. = 4.096 sec, No = 0

Microgravity Science Glovebox (MSG) Troubleshooting and Repair

Start GMT 07-December-2015, 341/14:00:00



Description	
Sensor	SAMS 121f04 500.0 sa/sec, 200.0 Hz
Location	LAB1O2, ER1, Lower Z Panel
Plot Type	Spectrogram

Notes:

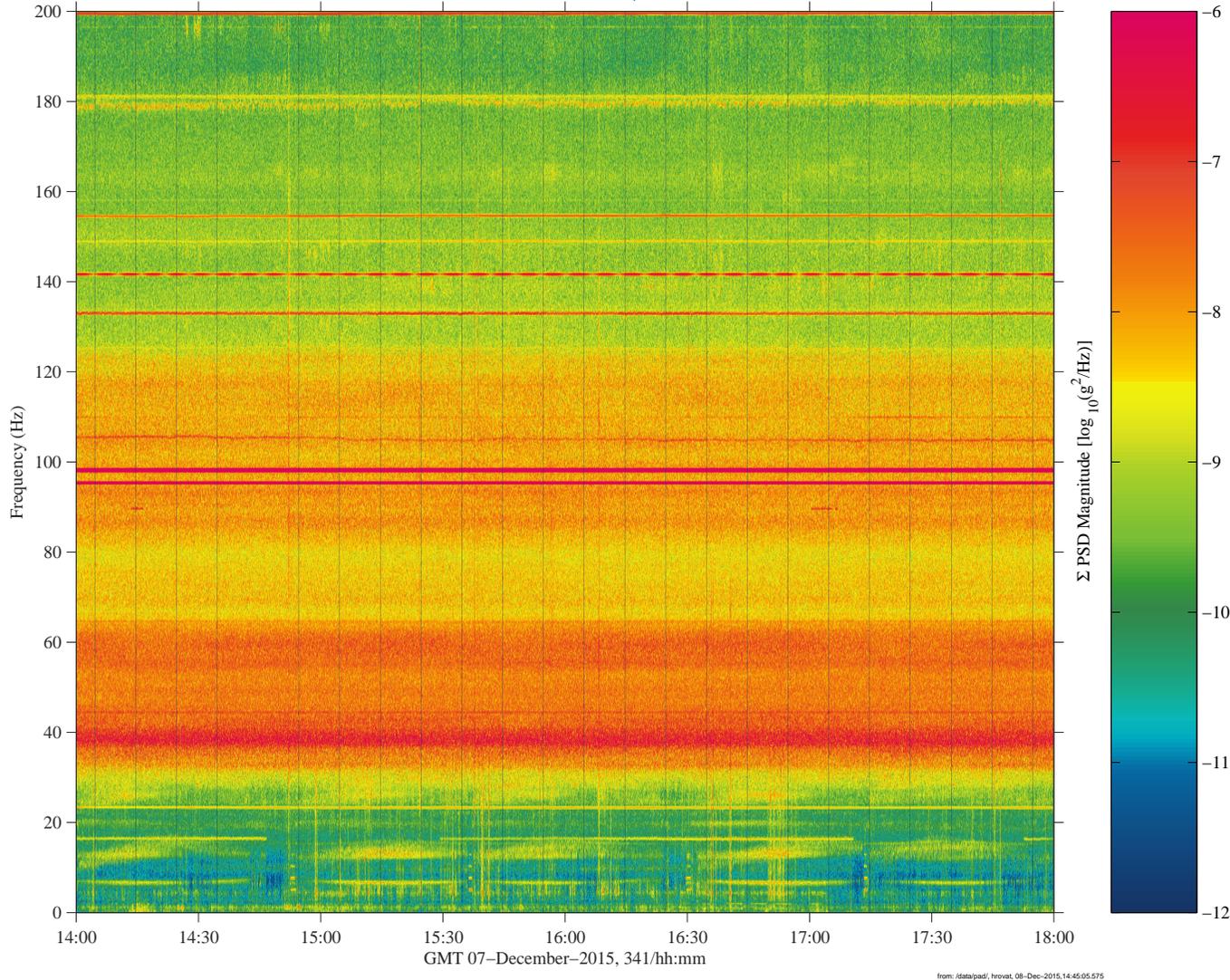
- The color spectrogram here shows the same span as the previous plot during troubleshooting and repair of the MSG at LAB1S2. The measurements used to compute this spectrogram came from the SAMS 121f04 sensor on the lower Z-panel of ER1, LAB1O2.
- The impulsive nature of the crew activity was not as notable or stark as was seen in the HiRAP data on the previous plot. Here, the activity shows up as yellow vertical streaks between about 15:00 and 17:00.

Regime:	Vibratory
Category:	Equipment
Source:	MSG Troubleshooting and Repair



sams2, 121f03 at LAB1O1, ER2, Lower Z Panel:[191.54 -40.54 135.25]
 500.0000 sa/sec (200.00 Hz)
 $\Delta f = 0.244$ Hz, Nfft = 2048
 Temp. Res. = 4.096 sec, No = 0

Microgravity Science Glovebox (MSG) Troubleshooting and Repair
 Start GMT 07-December-2015, 341/14:00:00



from: /data/padi_trovat_08-Dec-2015,14:45:05.575

MSG Troubleshooting and Repair Qualify

Description	
Sensor	SAMS 121f03 500.0 sa/sec, 200.0 Hz
Location	LAB1O1, ER2, Lower Z Panel
Plot Type	Spectrogram

Notes:

- The color spectrogram here shows the same span as the previous plot during troubleshooting and repair of the MSG at LAB1S2. The measurements used to compute this spectrogram came from the SAMS 121f03 sensor on the lower Z-panel of ER2, LAB1O1.
- Despite this sensor being in the US Lab, we again see that the impulsive nature of the crew activity was not as notable or stark as was seen in the HiRAP data.

Regime:	Vibratory
Category:	Equipment
Source:	MSG Troubleshooting and Repair

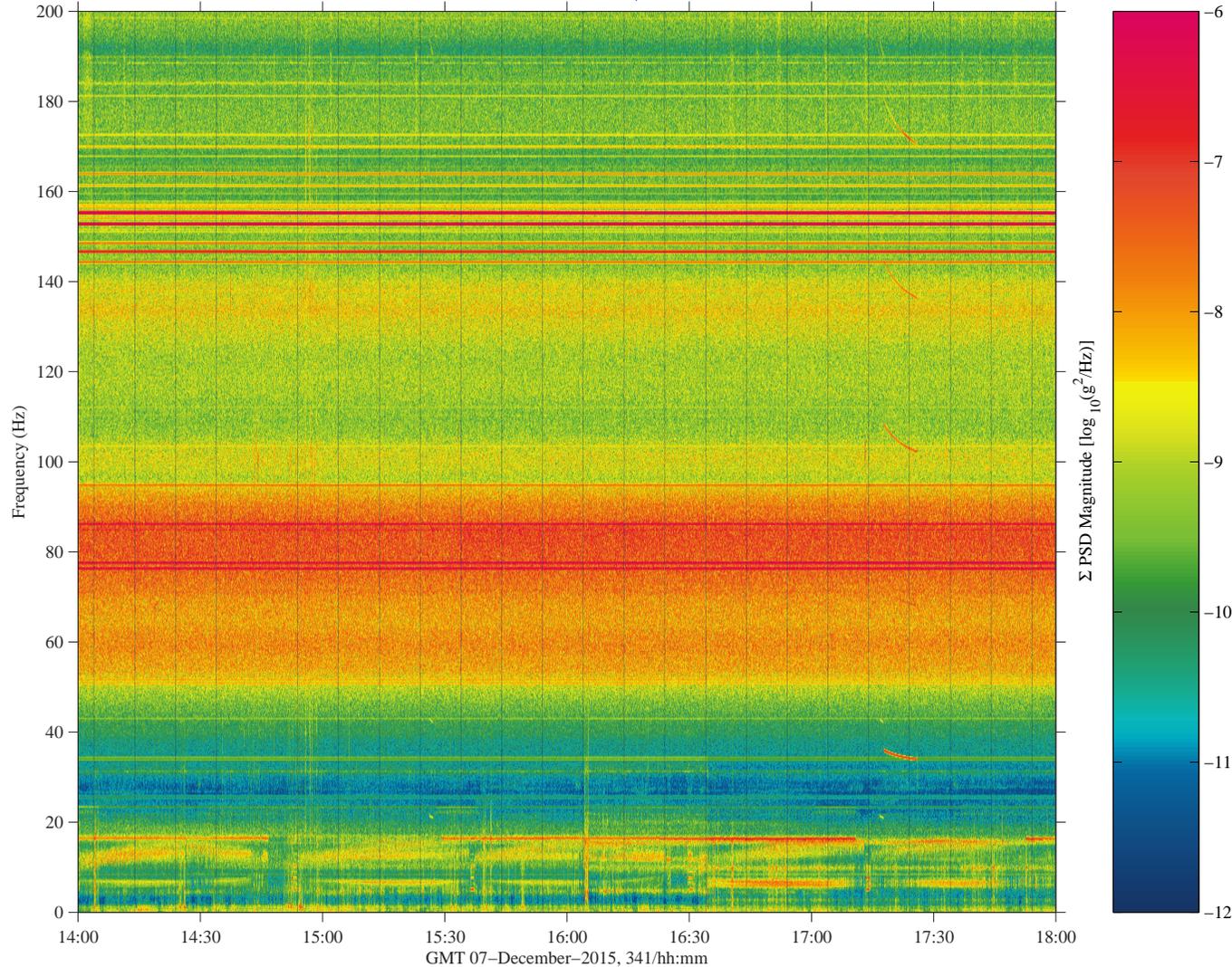


MSG Troubleshooting and Repair Qualify

sams2, 121f02 at COL1F1 H2, Seat Track near EML on EDR:[460.38 193.43 204.98]
 500.0000 sa/sec (200.00 Hz)
 $\Delta f = 0.244$ Hz, Nfft = 2048
 Temp. Res. = 4.096 sec, No = 0

Microgravity Science Glovebox (MSG) Troubleshooting and Repair

Start GMT 07–December–2015, 341/14:00:00



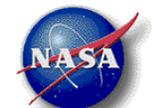
from: /data/padi_trovat_08-Dec-2015,14:48:56.534

Description	
Sensor	SAMS 121f02 500.0 sa/sec, 200.0 Hz
Location	COL1F1 H2, Seat Track near EML on EDR
Plot Type	Spectrogram

Notes:

- The color spectrogram here shows the same span as the previous plot during troubleshooting and repair of the MSG at LAB1S2. The measurements used to compute this spectrogram came from the SAMS 121f02 sensor on a seat track device near the Electromagnetic Levitator (EML) in the European Drawer Rack (EDR) COL1F1 in the Columbus laboratory module.
- An unrelated, but interesting ~ 34.3 Hz signature does appear in this spectrogram, starting at about GMT 17:17 and ending abruptly at about GMT 17:26. This signature has upper harmonics seen just over 100 Hz, at about 140 Hz, and between about 170 and 180 Hz.

Regime:	Vibratory
Category:	Equipment
Source:	MSG Troubleshooting and Repair

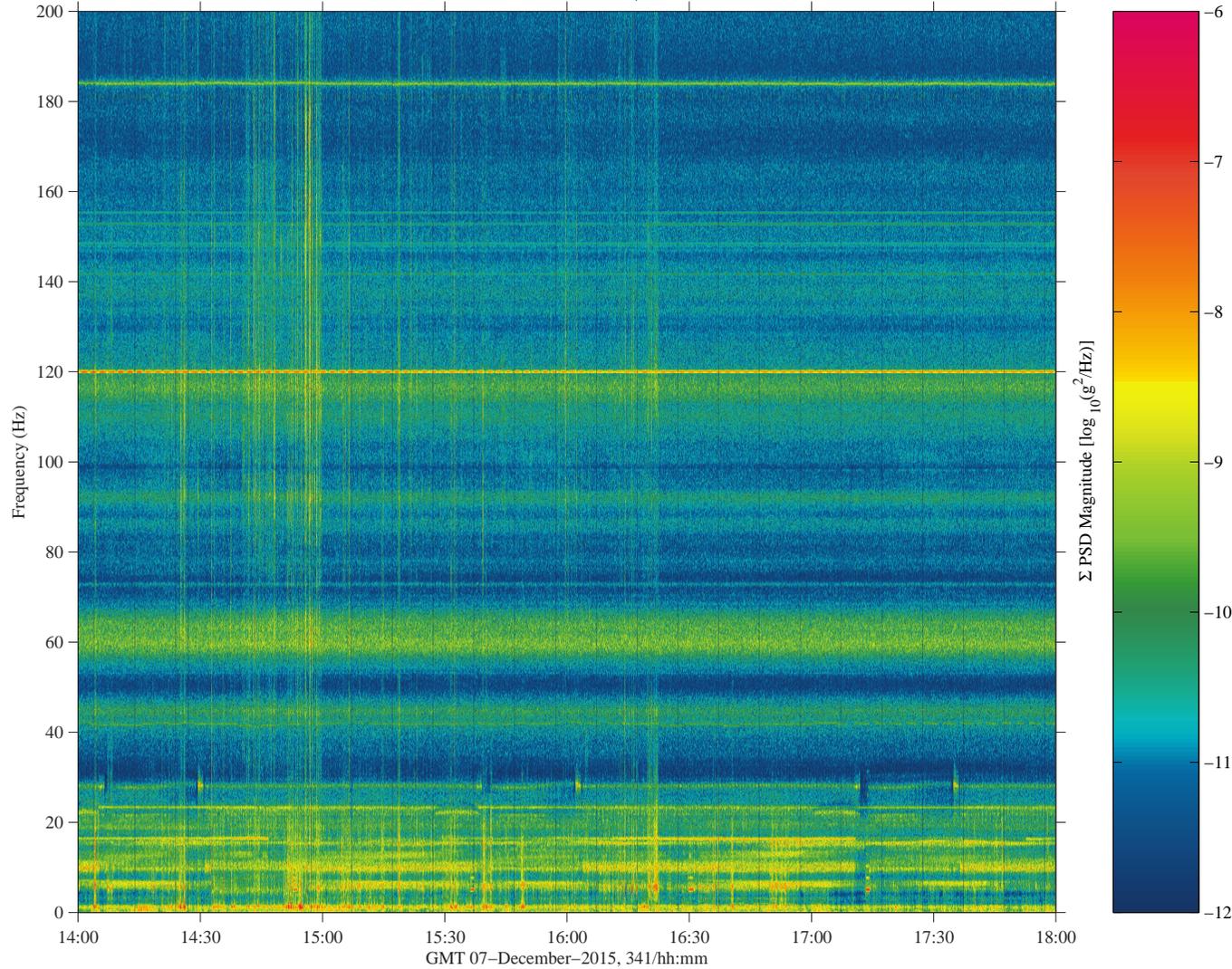


MSG Troubleshooting and Repair Qualify

sams2, 121f08 at COL1A3, EPM, near PK-4:[371.17 287.43 165.75]
 500.0000 sa/sec (200.00 Hz)
 $\Delta f = 0.244$ Hz, Nfft = 2048
 Temp. Res. = 4.096 sec, No = 0

Microgravity Science Glovebox (MSG) Troubleshooting and Repair

Start GMT 07-December-2015, 341/14:00:00

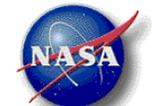


Description	
Sensor	SAMS 121f08 500.0 sa/sec, 200.0 Hz
Location	COL1A3, EPM, near PK-4
Plot Type	Spectrogram

Notes:

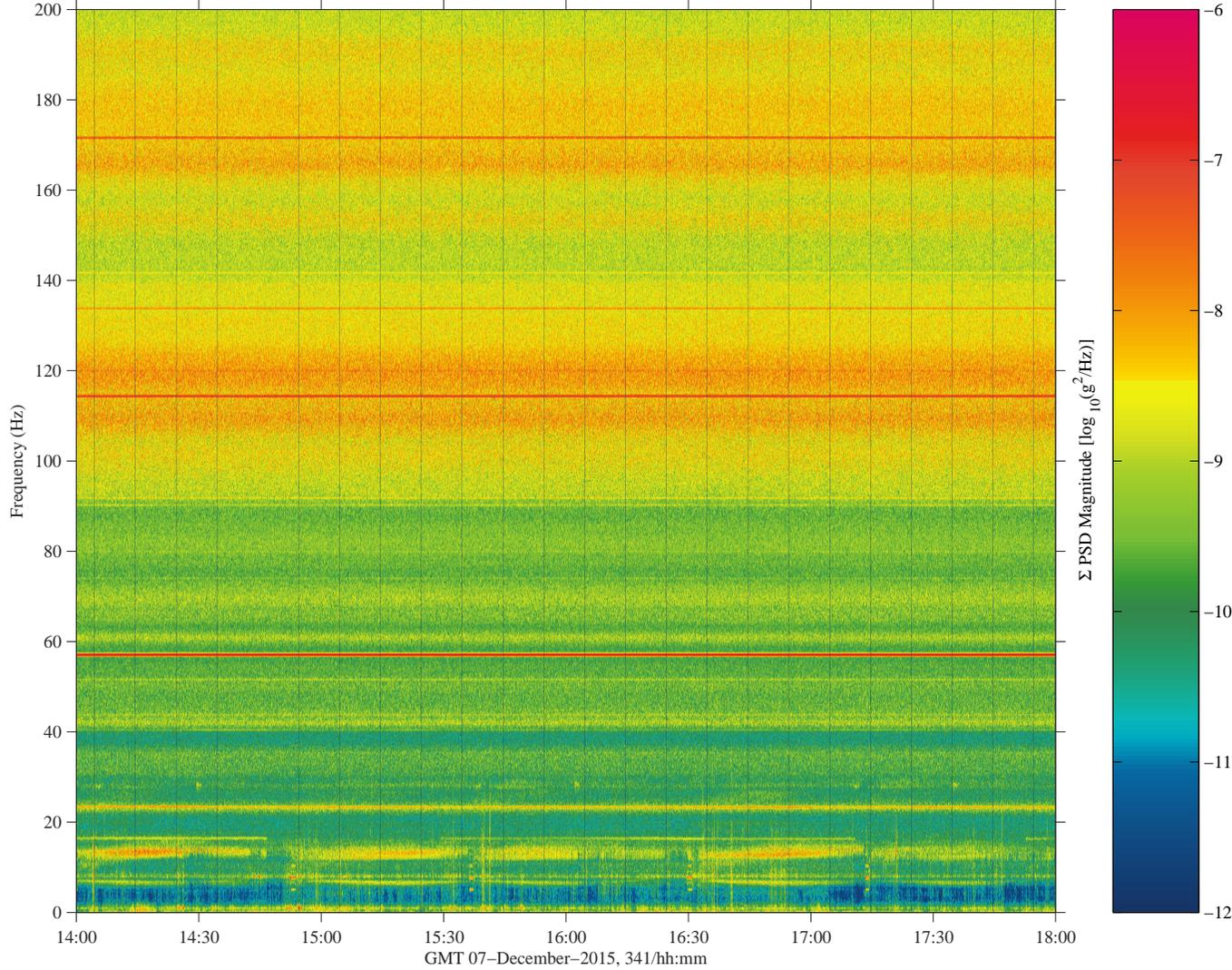
- The color spectrogram here shows the same span as the previous plot during troubleshooting and repair of the MSG at LAB1S2. The measurements used to compute this spectrogram came from the SAMS 121f08 sensor mounted on the European Physiology Module (EPM) rack near the PK-4 experiment COL1A3 location in the Columbus laboratory module.
- This sensor, being in the Columbus module, does not definitively show the crew activity here. Furthermore, the overall blueness suggests not much rack activity either.

Regime:	Vibratory
Category:	Equipment
Source:	MSG Troubleshooting and Repair



sams2, 121f05 at JPM1F5, ER4, Drawer 2:[466.80 -292.06 214.58]
 500.0000 sa/sec (200.00 Hz)
 $\Delta f = 0.244$ Hz, Nfft = 2048
 Temp. Res. = 4.096 sec, No = 0

Microgravity Science Glovebox (MSG) Troubleshooting and Repair
 Start GMT 07-December-2015, 341/14:00:00



from: /data/padi_trovat_08-Dec-2015,14:41:35.910

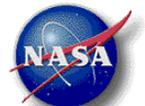
MSG Troubleshooting and Repair Qualify

Description	
Sensor	SAMS 121f05 500.0 sa/sec, 200.0 Hz
Location	JPM1F5, ER4, Drawer 2
Plot Type	Spectrogram

Notes:

- The color spectrogram here shows the same span as the previous plot during troubleshooting and repair of the MSG at LAB1S2. The measurements used to compute this spectrogram came from the SAMS 121f05 sensor mounted inside of JPM1F5 (ER4) in the Japanese Experiment Module (JEM).
- This sensor does not definitively show the crew activity here.

Regime:	Vibratory
Category:	Equipment
Source:	MSG Troubleshooting and Repair



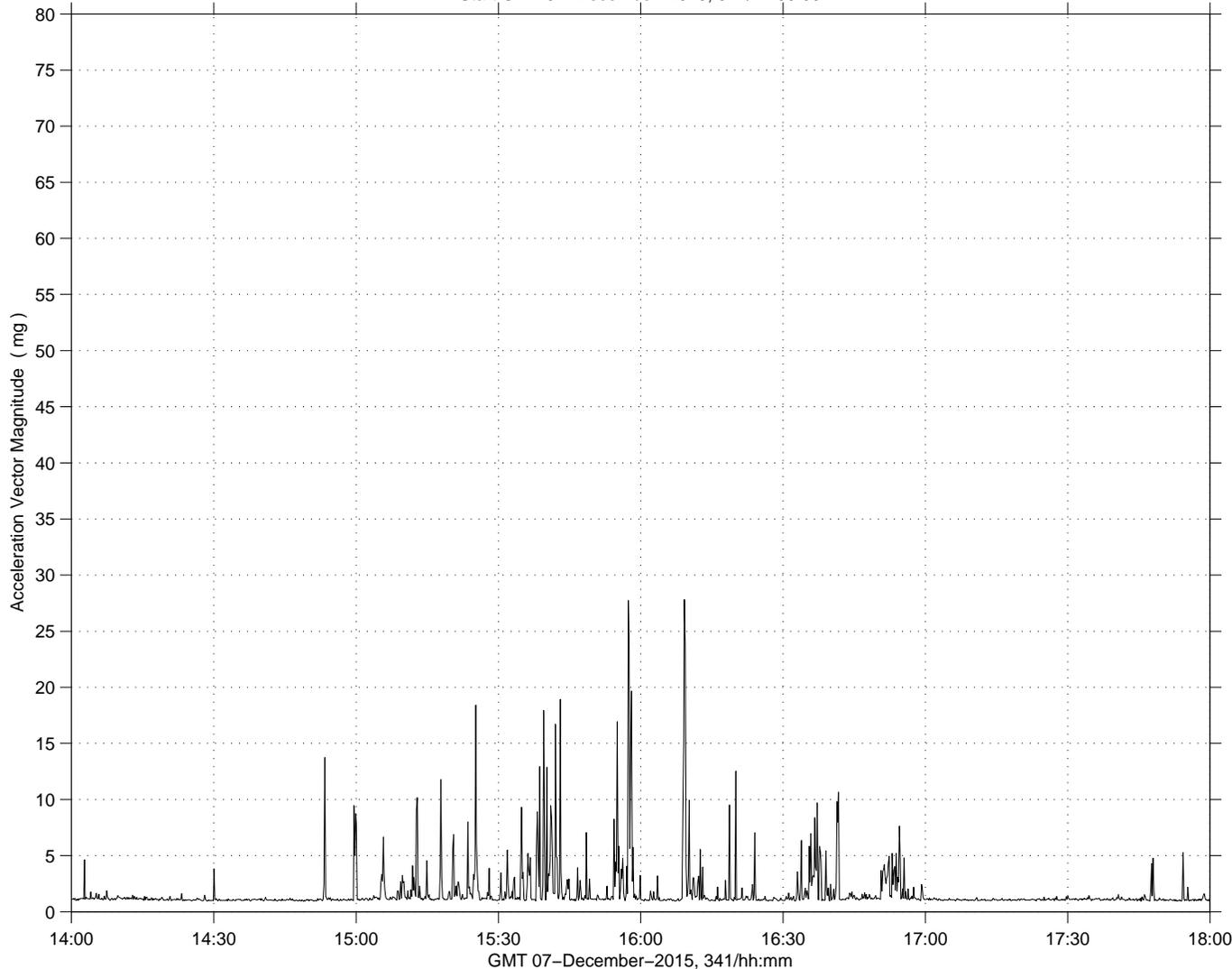
MSG Troubleshooting and Repair Qualify

mams, hirap at LAB102, ER1, Lockers 3,4:[138.68 -16.18 142.35]
0.1000 sa/sec (100.00 Hz)

Microgravity Science Glovebox (MSG) Troubleshooting and Repair

Vector Magnitude
Interval Max
Size: 10.00, Step: 10.00 sec.

Start GMT 07-December-2015, 341/14:00:00



Description	
Sensor	MAMS hirap 1000.0 sa/sec, 100.0 Hz
Location	LAB102, ER1, Lockers 3,4
Plot Type	Int. Max Vector Mag. vs. Time

Notes:

- The plot of acceleration vector magnitude interval max values here shows the same 4-hour span around the 15:00-17:00 (2-hour) window allocated for crew activity to troubleshoot and repair the Microgravity Science Glovebox (MSG), which is rack location LAB1S2. The measurements used to compute this plot came from the MAMS HiRAP sensor in ER1, LAB102.
- These data clearly quantify the impact of this crew activity at the HiRAP location in ER1. Note the large spikes between 15:00 and 17:00.
- The last page of this document shows a comparison that includes values from this plot, comparing them to other SAMS sensors distributed throughout the space station.
- It is worth noting that the SAMS sensors all had a higher cutoff frequency (200 Hz) relative to MAMS HiRAP, which is 100 Hz.

Regime:	Vibratory
Category:	Equipment
Source:	MSG Troubleshooting and Repair



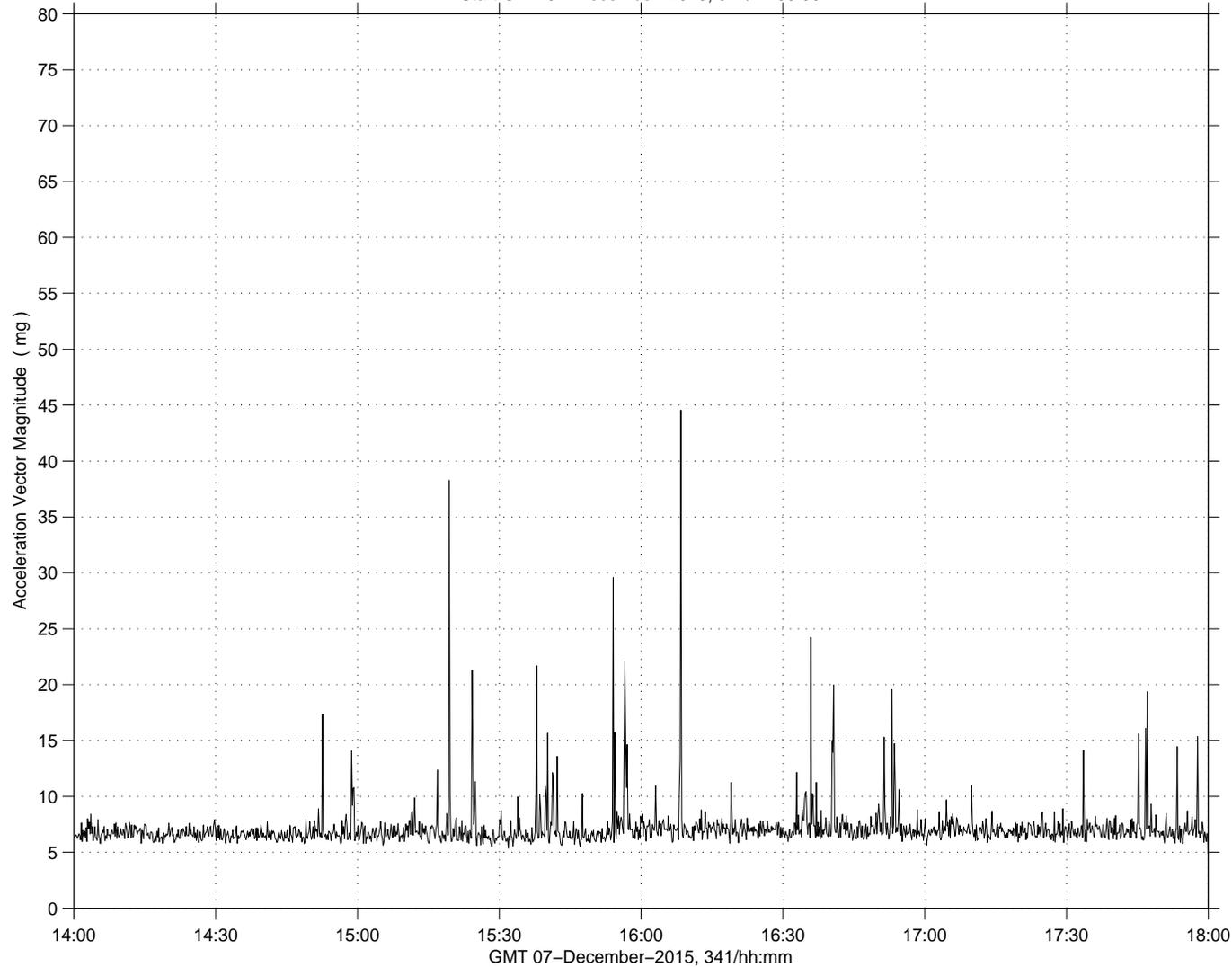
MSG Troubleshooting and Repair Qualify

sams2, 121f04 at LAB1O2, ER1, Lower Z Panel:[149.54 -40.54 135.25]
0.1000 sa/sec (200.00 Hz)

Microgravity Science Glovebox (MSG) Troubleshooting and Repair

Vector Magnitude
Interval Max
Size: 10.00, Step: 10.00 sec.

Start GMT 07-December-2015, 341/14:00:00



Description	
Sensor	SAMS 121f04 500.0 sa/sec, 200.0 Hz
Location	LAB1O2, ER1, Lower Z Panel
Plot Type	Int. Max Vector Mag. vs. Time

Notes:

- The plot of acceleration vector magnitude interval max values here shows the same 4-hour span as on the previous page. The measurements used to compute this plot came from the SAMS 121f04 sensor in ER1, LAB1O2.
- These data clearly quantify the impact of this crew activity at the 121f04 sensor location on ER1. Note the large spikes between 15:00 and 17:00.
- Notice the larger baseline value too (around 6 or 7 mg) compared to HiRAP seen on previous page at about 1 mg. Some of this difference we attribute to the difference in cutoff frequencies.

Regime:	Vibratory
Category:	Equipment
Source:	MSG Troubleshooting and Repair



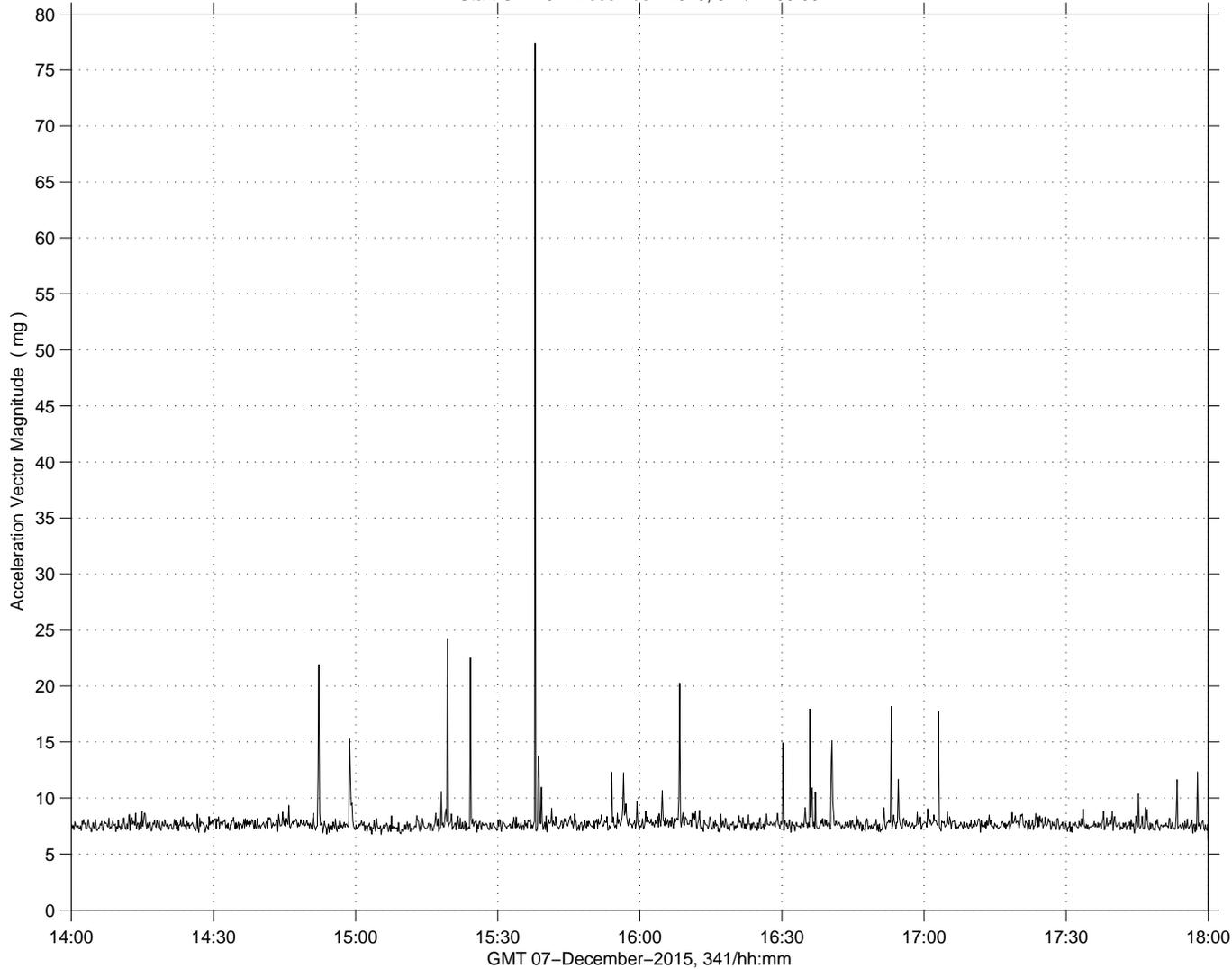
MSG Troubleshooting and Repair Qualify

sams2, 121f03 at LAB1O1, ER2, Lower Z Panel:[191.54 -40.54 135.25]
0.1000 sa/sec (200.00 Hz)

Microgravity Science Glovebox (MSG) Troubleshooting and Repair

Vector Magnitude
Interval Max
Size: 10.00, Step: 10.00 sec.

Start GMT 07-December-2015, 341/14:00:00



Description	
Sensor	SAMS 121f03 500.0 sa/sec, 200.0 Hz
Location	LAB1O1, ER2, Lower Z Panel
Plot Type	Int. Max Vector Mag. vs. Time

Notes:

- The plot of acceleration vector magnitude interval max values here shows the same 4-hour span as on the previous page. The measurements used to compute this plot came from the SAMS 121f03 sensor on ER2, LAB1O1.
- These data clearly quantify the impact of this crew activity at the 121f03 sensor location on ER2. Note especially the large spike just after 15:30, which may have come from crew interaction with structure very near the sensor (e.g. foot push-off or handhold usage).

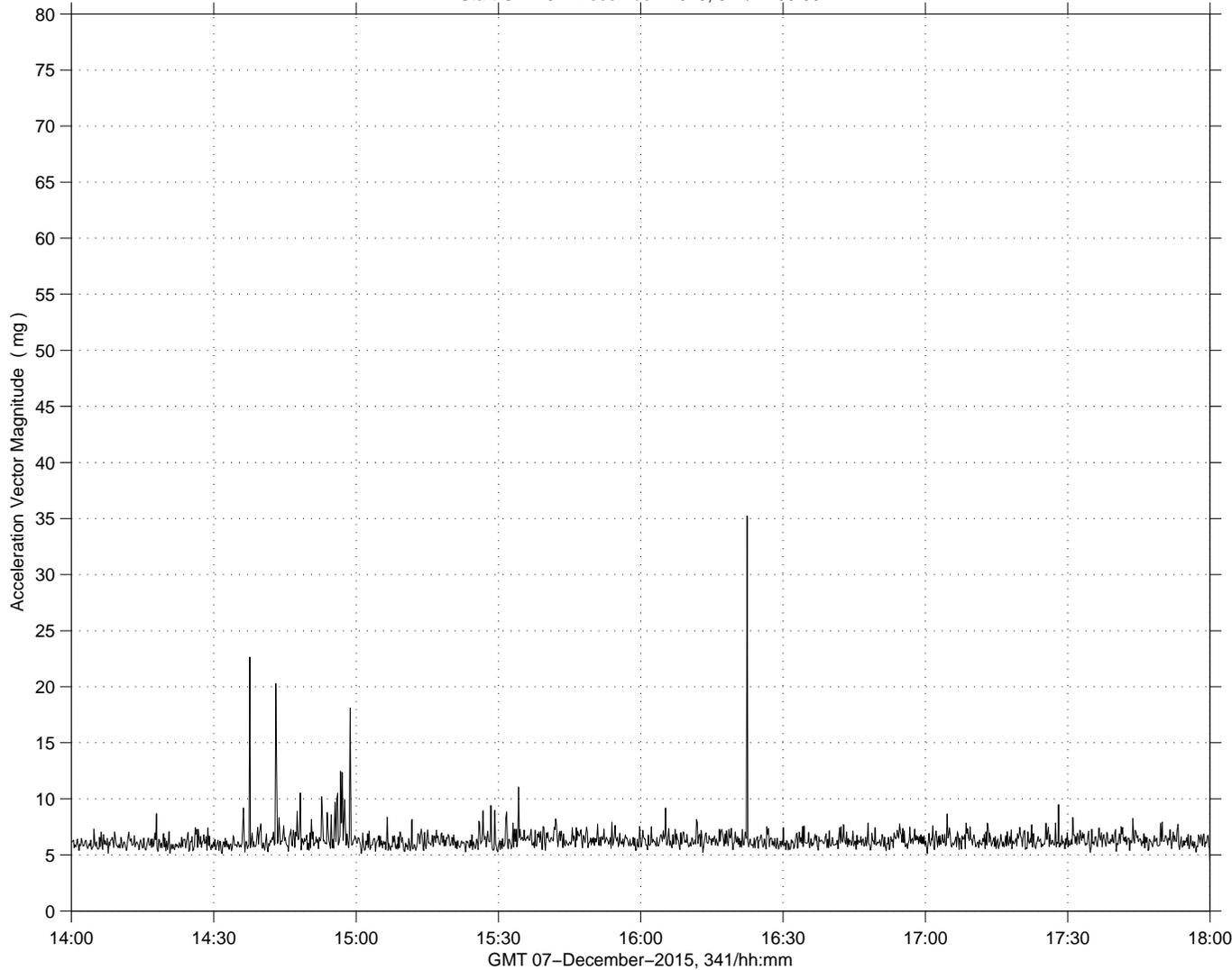
Regime:	Vibratory
Category:	Equipment
Source:	MSG Troubleshooting and Repair



Microgravity Science Glovebox (MSG) Troubleshooting and Repair

Vector Magnitude
Interval Max
Size: 10.00, Step: 10.00 sec.

Start GMT 07–December–2015, 341/14:00:00



MSG Troubleshooting and Repair Qualify

Description	
Sensor	SAMS 121f02 500.0 sa/sec, 200.0 Hz
Location	COL1F1 H2, Seat Track near EML on EDR
Plot Type	Int. Max Vector Mag. vs. Time

Notes:

- The plot of acceleration vector magnitude interval max values here shows the same 4-hour span as on the previous page. The measurements used to compute this plot came from the SAMS 121f02 sensor on the EDR rack location (COL1F1) near EML.
- These data do not as clearly quantify the impact of this crew activity at the 121f02 sensor location on EDR. Note only one large spike between 15:00 and 17:00 and this may have been caused by a different crew member nearer to this sensor doing something completely unrelated.

Regime:	Vibratory
Category:	Equipment
Source:	MSG Troubleshooting and Repair



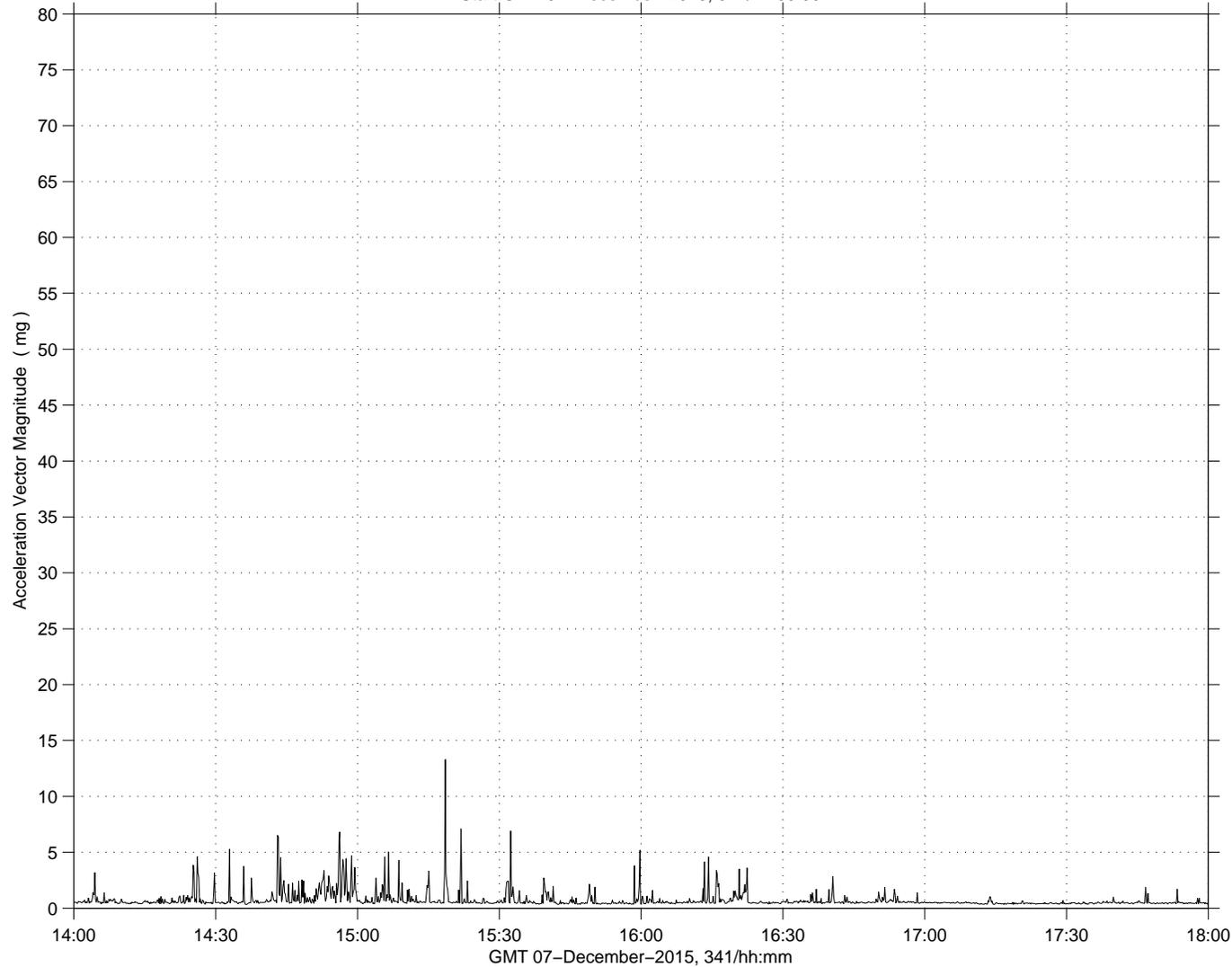
MSG Troubleshooting and Repair Qualify

sams2, 121f08 at COL1A3, EPM, near PK-4:[371.17 287.43 165.75]
0.1000 sa/sec (200.00 Hz)

Microgravity Science Glovebox (MSG) Troubleshooting and Repair

Vector Magnitude
Interval Max
Size: 10.00, Step: 10.00 sec.

Start GMT 07-December-2015, 341/14:00:00

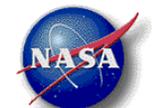


Description	
Sensor	SAMS 121f08 500.0 sa/sec, 200.0 Hz
Location	COL1A3, EPM, near PK-4
Plot Type	Int. Max Vector Mag. vs. Time

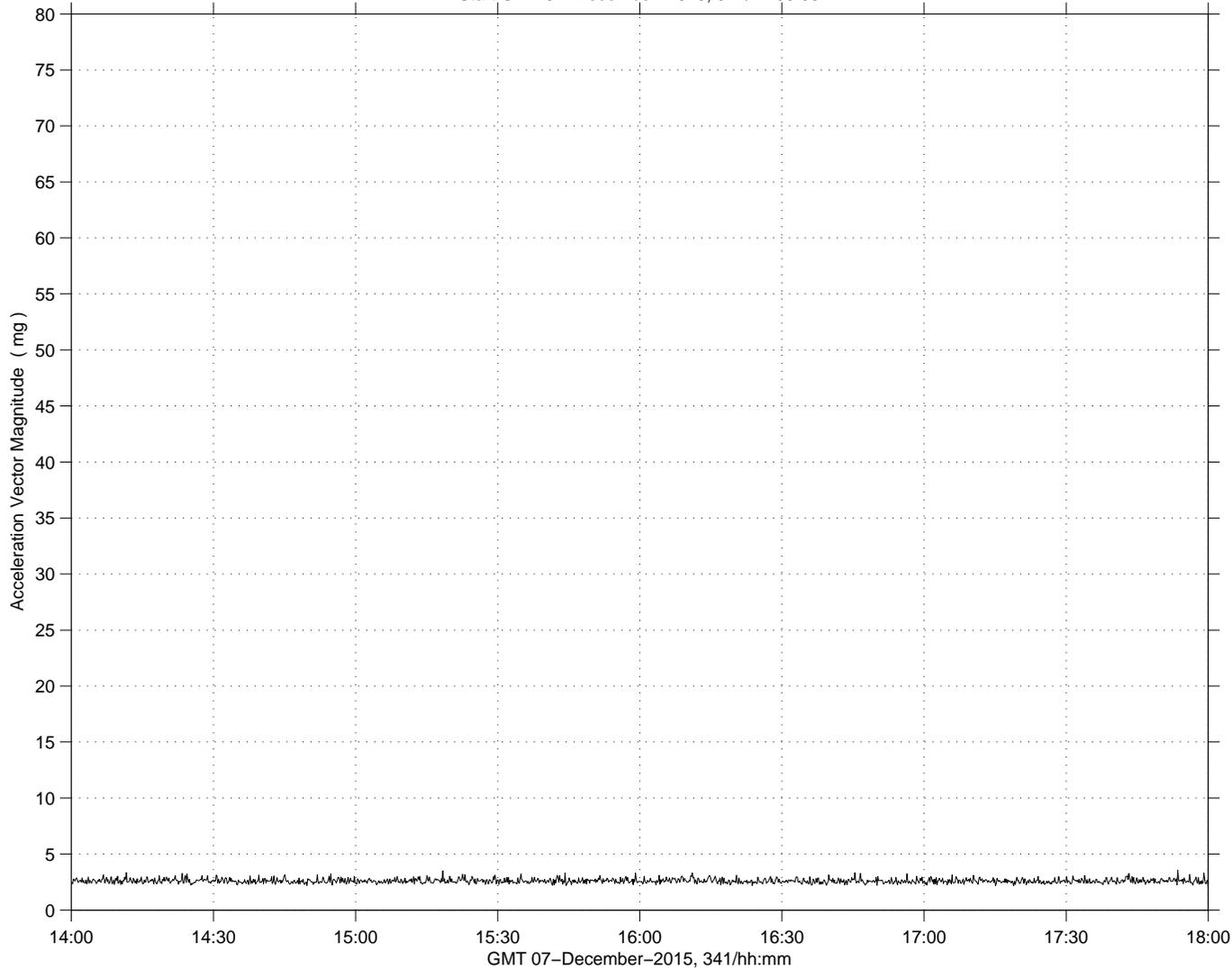
Notes:

- The plot of acceleration vector magnitude interval max values here shows the same 4-hour span as on the previous page. The measurements used to compute this plot came from the SAMS 121f08 sensor on the EPM rack (COL1A3) near the PK-4 experiment.
- This sensor, in the Columbus module, does not clearly correlate with the crew activity at the MSG in the US Lab.

Regime:	Vibratory
Category:	Equipment
Source:	MSG Troubleshooting and Repair



Start GMT 07-December-2015, 341/14:00:00



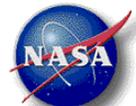
MSG Troubleshooting and Repair Qualify

Description	
Sensor	SAMS 121f05 500.0 sa/sec, 200.0 Hz
Location	JPM1F5, ER4, Drawer 2
Plot Type	Int. Max Vector Mag. vs. Time

Notes:

- The plot of acceleration vector magnitude interval max values here shows the same 4-hour span as on the previous page. The measurements used to compute this plot came from the SAMS 121f05 sensor in the Japanese Pressurized Module (JPM1F5).
- This sensor did not detect the crew activity in the US Lab from its mounting location in the Japanese module.

Regime:	Vibratory
Category:	Equipment
Source:	MSG Troubleshooting and Repair



MSG Troubleshooting and Repair Qualify

The table of values below were taken from the acceleration vector magnitude interval max values plotted on the previous 6 pages of this document. The baseline values (median) were calculated across the 4-hour span in each case. The "Top 5" were the five largest acceleration vector magnitudes across the 4-hour span as well. Note that the HiRAP and 121f04 sensors were closest to the crew activity, and data from those sensors naturally show this activity most clearly.

Sensor:	HiRAP	121f04	121f03	121f02	121f08	121f05
Rack Location:	LAB102	LAB102	LAB101	COL1F1	COL1A3	JPM1F5
Cutoff (Hz):	100	200	200	200	200	200
Median (mg):	1.11	6.77	7.61	6.18	0.50	2.58
Top 5 (mg):	27.82	44.57	77.38	35.23	3.30	3.55
	27.74	38.26	24.18	22.64	7.09	3.51
	23.76	29.56	22.52	20.28	6.91	3.36
	23.31	24.22	21.92	18.08	6.82	3.34
	19.67	22.05	20.28	12.45	6.51	3.32

